FEDERAL AVIATION ADMINISTRATION INFORMATION TECHNOLOGY STRATEGY FY2000 – FY2002

Version 1.0

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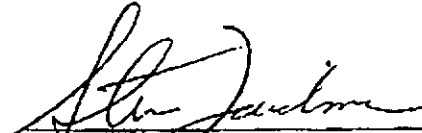**Office of Information Services**
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September 22, 1999
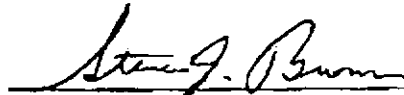
Information Technology Strategy

We, the undersigned, agree to the content and execution of the FAA's Information Technology Strategy, as detailed in the attached document.
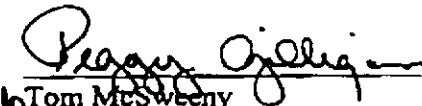
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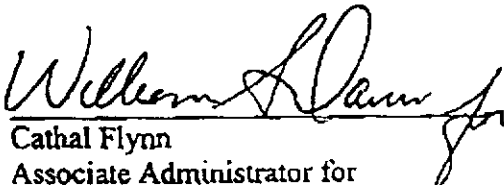 Information Services and CIO, AIO-1

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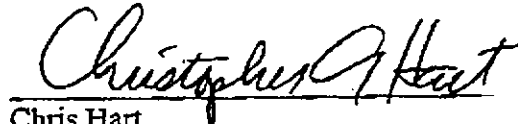
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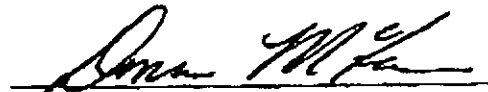
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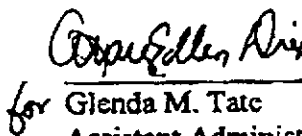
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Executive Summary

The Federal Aviation Administration's (FAA's) strategic goals to increase the safety, security, and efficiency of the National Airspace System depend on effective management of the agency's information technology (IT) resources. The *FAA IT Strategy* represents the first iteration of the FAA's agency-wide approach to IT management. It establishes the strategic framework to guide IT investment decisions and the agency-wide management of IT systems and services.
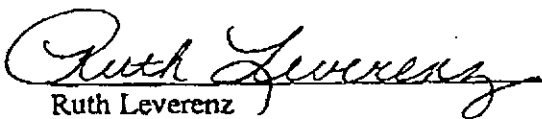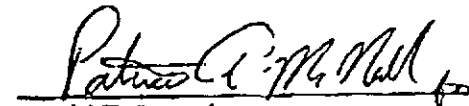
Consistent with the Clinger-Cohen Act, this strategy defines *information technology* broadly as, "… any equipment or interconnected system or subsystem of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the executive agency…"[1]. Consequently, this includes the information technology elements of such programs as the Wide Area Augmentation System, Controller Pilot Data-Link Communications, Safety Performance and Analysis System, Air Transport Oversight System, and Acquire, as well as such infrastructure as wide-area networks, local-area networks, desktops and e-mail.

This strategy was developed by an agency-wide team that started with the strategic and business plans of the lines of business, as well as the *FAA Strategic Plan* and the *FAA FY2000 Performance Plan*. The *FAA IT Strategy* responds to the agency's primary business drivers including: the growth in aviation traffic, the need to reduce already low fatality rates, user demand for new and improved services, constrained budgets, and growing information security threats. While the IT Strategy was developed with projected future budget levels in mind, implementation must track with available resources and be part of priorities set by the agency for capital investments and operations. Implementation of the goals, objectives, and strategies is dependent upon funding availability.

This strategy will touch most of the FAA because IT enables so much of the agency's primary business - managing air traffic and regulating civil aviation. The FAA Management Board has identified 49 key corporate projects over the next three years.[2] The success of the FAA over that time period will largely depend on how well those corporate projects are executed. Because these projects are so heavily dependent on information technology, we expect that no less than half of the 49 projects will be materially improved by the successful implementation of this IT Strategy. For instance, the Air Transport Oversight System project requires improved timeliness, availability, protection, and quality of safety information (*Information* and *Security* goals). The project to Improve National Airspace System Communications will benefit significantly from all of the goals outlined in this strategy as described next.

Information: Make reliable information available quickly. The FAA, in partnership with the aviation community, depends on vast amounts of information to safely and securely manage air traffic and to regulate the aviation industry. Dramatic growth in air traffic, increased collaboration between airspace users and the FAA for *Free Flight*, and new technologies, such as the Internet, increase the importance and difficulty of providing reliable timely information to

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[1] *Information Technology Management Reform Act of 1995* (aka Clinger-Cohen Act), Section 5002 (2); http://irm.cit.nih.gov/itmra/itmra96.html
[2] *FAA Corporate Projects for FY 2000-2002 and Thereafter*

agency users and staff. For example, reducing air travel delays requires that both the airlines and the FAA have up-to-date, accurate information on weather, airport conditions, and equipment outages. The infrastructure to enable such large-scale distributed exchange of information is being implemented over the next several years.

Cost: Reduce the cost of delivering IT services without reducing service quality. The FAA spends $2.1 billion annually on IT,[3] making it a high-volume buyer of information technology and services such as voice and data communications, desktops, and database management systems. By standardizing what it buys, by leveraging its position with vendors as a high-volume buyer, by coordinating the purchase and operation of related IT services, by creating the right management incentives, and by adhering to an agency-wide IT architecture (which exists only in part today), the agency will significantly improve the cost-effectiveness of IT. Reducing costs rather than just reducing the rate at which costs rise is necessary given projected agency budgets. The FAA will improve its understanding of the total cost of ownership from conception through implementation, operation, and eventual retirement for major systems. Better insight into total cost of ownership will enable lower overall systems costs.

Security: Safeguard information assets. The phenomenal growth of the Internet and computer skills of the public has created unprecedented potential to threaten the critical infrastructure of the United States, including the air traffic management system. Compounding these opportunities is the rapid growth of automated information exchange between the FAA and airspace users. Responding to these threats, the FAA has developed a comprehensive program to assure that the National Airspace System and its supporting systems are immune to attack. Responding to *Presidential Decision Directive 63*, which mandates protection of the nation's critical infrastructure, the FAA has identified over 100 critical systems that are being "hardened" to resist attack. Additionally, the agency is establishing an incidents response center that will analyze attacks when they happen, ensure that they are promptly addressed, and continually probe the agency's information systems for new weaknesses.

People: Acquire and maintain critical IT knowledge, skills, and abilities. The aviation paradigm and information technology are changing so rapidly that keeping the workforce technologically current is daunting. Today, many FAA efforts focus on recruiting, retaining, and training its IT staff, but there is no consensus within the agency as to which are the most important IT knowledge, skills, and abilities, and no corporate program to acquire and develop people with those skills. Over the next three years, that consensus will be built, and programs put in place to acquire and develop people with critical IT knowledge, skills, and abilities, and to maintain those capabilities.

Business Value: Optimize IT decisions and resources across the agency. The FAA is acquiring, developing, and operating over 400 IT services and information systems, which enable the agency to carry out virtually all of its business functions. The FAA must decide which IT services and systems to obtain from outside sources and which to provide internally. For those services that the FAA decides to provide internally, the agency must decide which IT systems to buy *off the shelf,* which to develop and build, which to retire, and which to update; and then smartly execute those decisions. New management techniques will be implemented to

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[3] *FAA Information Technology 5 Year Plan*, July 1999

improve critical investment decisions and to more effectively carry them out. Related IT systems will be grouped into portfolios and managed to optimize the performance of the whole portfolio to support agency business objectives. Key processes on which execution depends will be re-engineered and systematically improved.

Innovation: Exploit technology opportunities. The air traffic management system is one of the largest and most complex systems in the world. It must be constantly modernized to meet the rapidly growing demands of the airspace users and the flying public. Reducing the already low fatal accident rate and improving the already high margin of security require new tools and new ways to look at data. Additionally, while the air traffic management system provides the greatest opportunity for exploiting new technology opportunities, there are also important opportunities in the other areas of the agency. The FAA needs to systematically identify which innovative information technologies can have the greatest impact and determine how best to integrate those technologies into its information systems. During the next several years, the agency will put in place a corporate approach to managing innovative technologies, and will evolve key IT systems to make best use of those technologies.

The diagram on the next page illustrates some of the value the goals contribute to each other, and to the FAA mission goals of *Aviation Safety*, *Security*, and *Efficiency*. The gray boxes in the diagram represent the goals, and the arrow-shaped boxes show the primary value that flows between those goals. For example, the *Business Value* goal contributes value to the FAA mission goals by improving the likelihood of program success (delivery of capabilities and quality of services). In addition, this goal contributes value to itself, through better use of IT investment dollars. The *Business Value* goal also benefits from the *Information* goal through better-informed decision making, the *Cost* goal through additional dollars saved, and the *People* goal through better IT decisions and use of resources.

Goals Contribute Value to Each Other
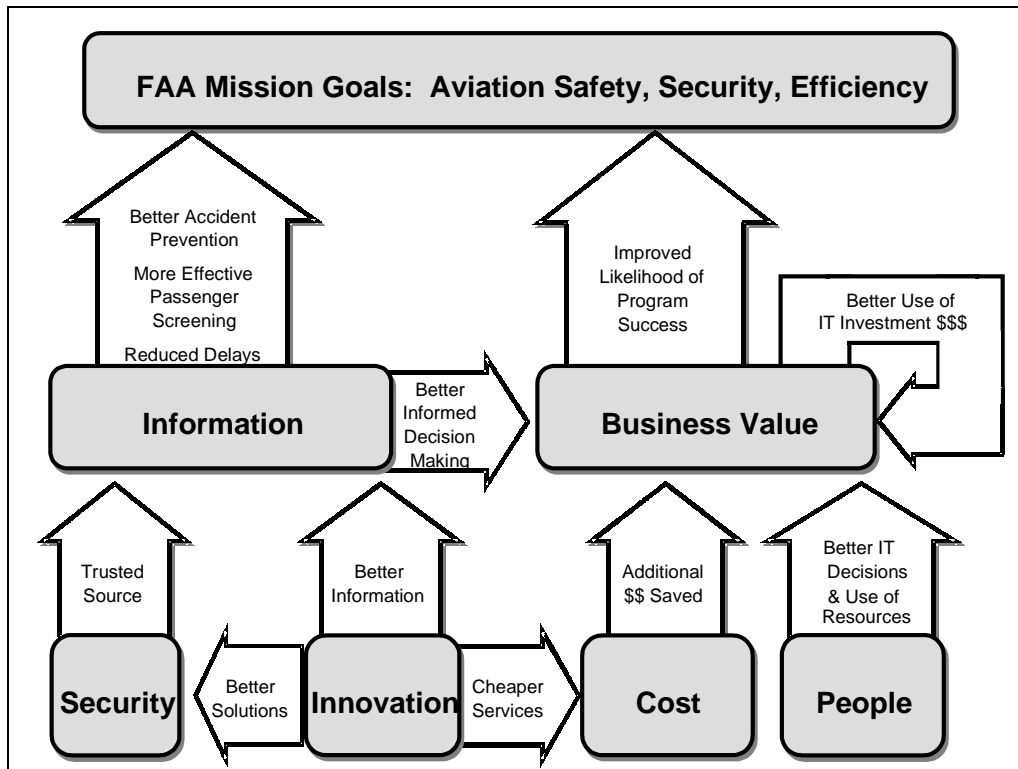
1 Introduction

The FAA has over 400 individual IT systems on which it spends approximately $2.1 billion annually[4] - around 20% of the total agency budget (25% if the Airport Improvement Program is excluded). The FAA's corporate IT challenge is to continually align that investment with the agency's evolving needs and strategic objectives. This strategy has been developed to guide the agency during FY00-FY02 in establishing and maintaining that alignment.

Because IT enables so much of the FAA's business, the implementation of this strategy will touch most of the agency. The FAA Management Board has identified 49 key corporate projects over the next three years[5]. The success of the FAA over that time period will largely depend on how well those corporate projects are executed. Because these projects are so heavily dependent on information technology, we expect that no less than half of the 49 projects will be materially improved by the successful implementation of this IT Strategy. For instance, the Air Transport Oversight System project requires improved timeliness, availability, protection, and quality of safety information (*Information* and *Security* goals). The project to Improve National Airspace System Communications will benefit significantly from all of the goals outlined in this strategy.

The strategy responds to the agency's primary business drivers:

- *Growth in Aviation Traffic*. Airline passengers are projected to increase from 608 million in 1998 to 931 million in 2010.[6]

- *Need to Reduce Already Low Fatality Rates*. The FAA is committed to reducing the already low U.S. aviation fatal accident rates by 80% from 1996 levels by 2007.[7]

- *User Demand for New and Improved Services*. With the increase in aviation traffic, industry users of the agency's services are demanding improvements in current services, as well as new services to meet the rising demand. Since the FAA is an information intensive organization, this demand for new and improved services requires an increasingly effective and efficient IT infrastructure, and services to satisfy the information needs of the agency and its customers.

- *Constrained Budgets*. Like all government agencies, the FAA is being asked to do more with less. Aviation traffic is increasing more rapidly than is the funding needed to handle that increase by traditional means. Given the funding model under which the agency operates, the FAA cannot increase revenues to match the increased demand for services. In order to meet increased demand with fewer relative resources, the agency must use its resources more wisely. A key opportunity available to the agency is to use IT to increase the effectiveness and efficiency of available resources.

- *New Technology Opportunities*. The FAA must leverage new technologies in order to meet its mission goals, and industry's demand for more services. Technologies such as

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[4] *FAA Information Technology 5 Year Plan*, July 1999
[5] *FAA Corporate Projects for FY 2000-2002 and Thereafter*
[6] *FAA Aerospace Forecasts, Fiscal Years 1999-2010*
[7] *1998 FAA Strategic Plan*; http://api.hq.faa.gov/apo120/98sp-fin.pdf

the Internet provide the environment for unprecedented information sharing. The FAA must incorporate these technologies into its organization to keep pace with its customers.

- *Growing Information Security Threats*. With new technology come increased threats to tamper with agency systems and information. In the past, systems were *self-contained*; one had to be physically present to tamper with the system. With the growth of global networks, and interconnectivity of critical systems, the agency must be vigilant against intrusions.

- *Business Reform*. IT, more than any other technology, can reshape the way the FAA does business. To meet its mission goal of system efficiency, the agency must leverage IT to reform its business processes. In a period of increased demand, with constrained budgets, business reform is critical to the agency's ability to deliver better services and to improve credibility with aviation industry users, Congress, and the public.

- *Replacement of Aging Systems*. Between FY00-FY02, the agency will replace a number of legacy systems. This strategy will help optimize agency investment in new systems by enabling all lines of business to take an agency-wide view of their investments.

The agency's overall response to those business drivers is documented in the *FAA Strategic Plan* and derivative strategic and business plans of the individual lines of business.

The term "information technology" has been used in a variety of ways within the FAA. Consistent with the Clinger-Cohen Act, this strategy defines *information technology* broadly as:

> "… any equipment or interconnected system or subsystem of equipment, that is used in the automatic acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of data or information by the executive agency … The term *information technology* includes computers, ancillary equipment, software, firmware and similar procedures, services (including support services), and related resources …" [8]

Consequently, this includes the information technology elements of such programs as Wide Area Augmentation System, Controller Pilot Data-Link Communications, Safety Performance and Analysis System, Air Transport Oversight System, and Acquire, as well as such infrastructure as wide-area networks, local-area networks, desktops and e-mail.

This strategy is based on several key assumptions:

- *Collaboration*. The lines of business will collaborate to implement the strategy.

- *Execute Within Existing Budget Guidelines*. This strategy leverages requested resources for information technology and information security within existing Office of Management and Budget budget guidelines and through alignment of priorities within the lines of business. If additional funding is required, it will be considered along with other agency priorities.

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[8] *Information Technology Management Reform Act of 1995* (aka Clinger-Cohen Act), Section 5002 (2); http://irm.cit.nih.gov/itmra/itmra96.html

- *Alignment*. The goals will largely be achieved by aligning funding that is already allocated to existing programs and activities.

The FAA must focus on optimizing decisions across the agency, which will require a culture change. The success of this strategy depends on making that change. Fortunately, there is a strong sense of commitment to that change from the FAA Management Board. That commitment, and the willingness of the lines of business to work cooperatively and align funding to meet the strategy's goals, will ensure this strategy's success.

The IT Strategy was developed by an agency-wide team that started with the strategic and business plans of the lines of business, as well as the *FAA Strategic Plan* and the *FAA FY2000 Performance Plan*. Figure 1 below illustrates the relationship between this strategy and the other plans within the agency.

Figure 1 – Relationship between IT Strategy and Existing FAA plans.
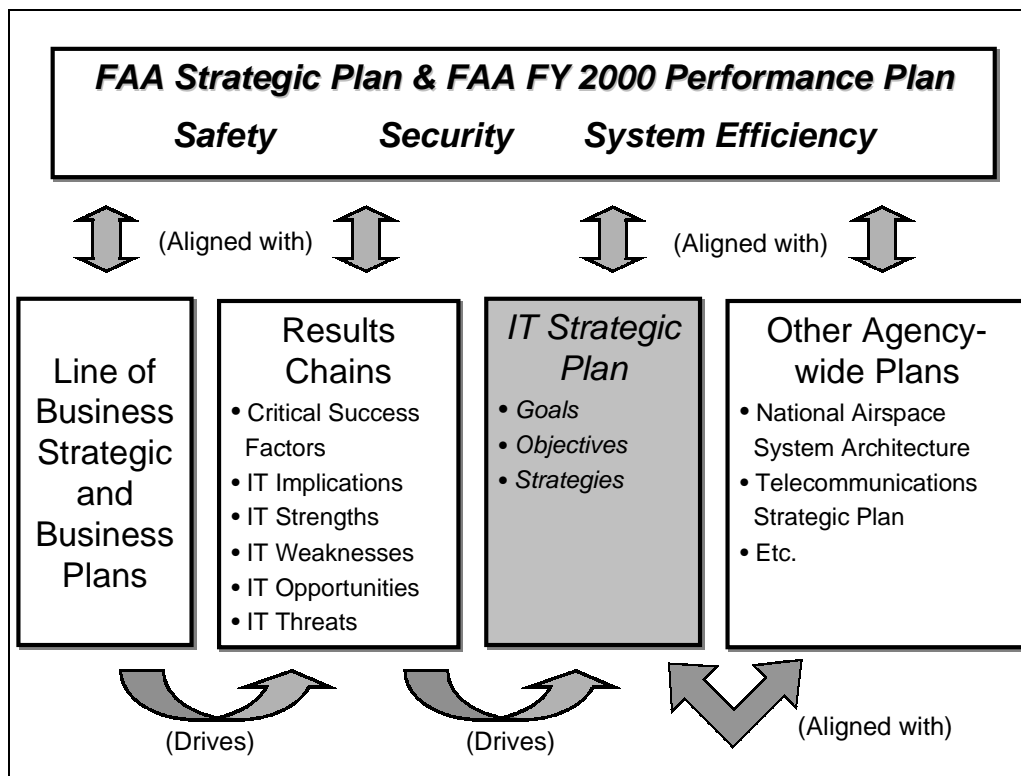
Looking first at the key business goals and objectives of the FAA and lines of business strategic and business plans, the team identified critical success factors, IT implications, strengths, weaknesses, opportunities, and threats. This identification was documented in *Results Chains*, an example of which is in Appendix B. The *Results Chains* were developed as a tool to ensure that business goals and objectives of the agency drove the IT Strategy. From the information in these chains, the team was able to craft six IT goals that have agency-wide impact. Each goal, which is a qualitative statement of a desired outcome, was subsequently refined into two or three quantitative objectives of measurable outcomes to be achieved on a definite timetable. Finally,
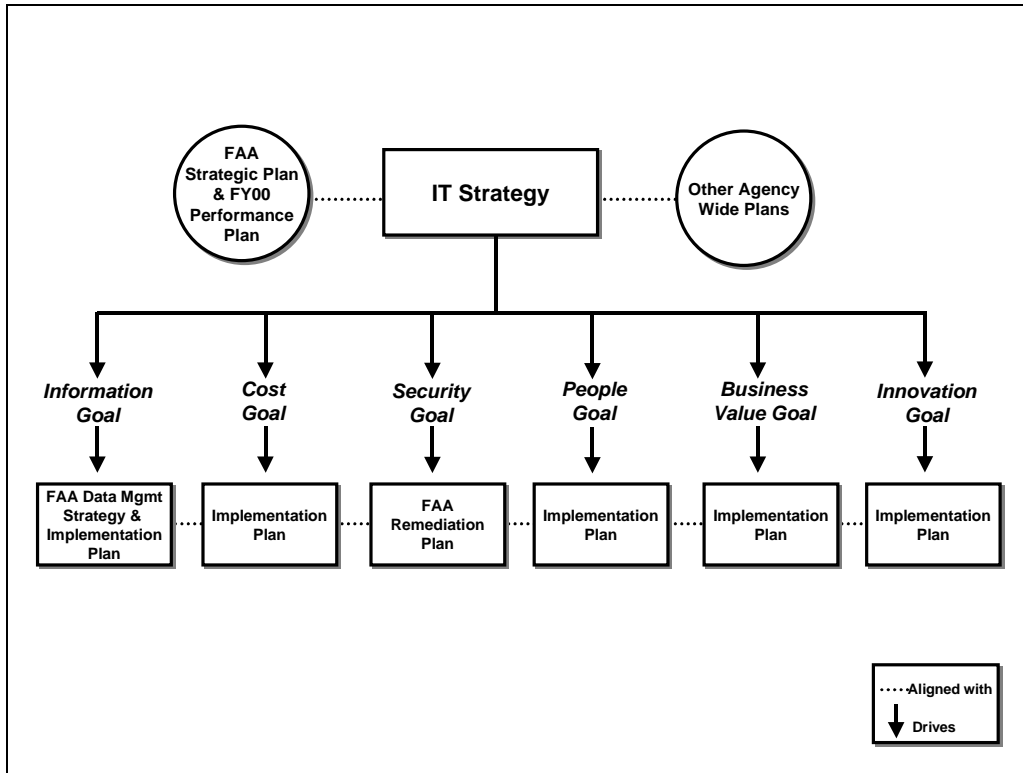
the team defined strategies to realize the objectives. Table 1 states these goals, objectives, and strategies.

A common theme in many of the objectives is to focus on *critical*, *selected* or *targeted* information, databases, positions, etc. Executives from the various lines of business and key staff offices will collectively select the items on which to focus. By leaving the selection open at this time, it allows the agency to concentrate the objectives on those items that will have the greatest impact on the goals. The criteria for this selection will be the importance to the agency in achieving its mission goals, the cost-benefit of implementing changes, and the ability to make improvements while continuing to deliver quality services.

Many of the goals have a strategy that proposes the establishment of a group or team to implement the goal. Where appropriate, existing groups or a combination of existing groups should be leveraged to serve as these implementation teams, rather than create new ones. It is essential that the members of these implementation teams are at the appropriate level and have the authority to make the necessary decisions for their organization.

The next step in this process is to complete implementation plans for the goals. The strategies for the *Information* and *Security* goals are developed, and have implementation plans nearing completion, the *FAA Data Management Strategy* and the *FAA Remediation Plan*, respectively. Teams with agency-wide membership developed these plans. Similar plans must be developed around the other four goals. With the Office of Information Services and Chief Information Officer as the lead, teams will be formed with membership from across the agency to develop these plans. Figure 2 illustrates the IT strategic planning process. The Office of Information Services and Chief Information Officer will ensure the alignment of the implementation plans with each other and with the FAA mission goals. Periodically, the IT Strategy will be revised to respond to insights gained from the implementation teams, changes in the business or technological environment, and to ensure alignment with the FAA mission goals.

Figure 2 – IT Strategic Planning Process

Table 1 – Goals, Objectives, and Strategies

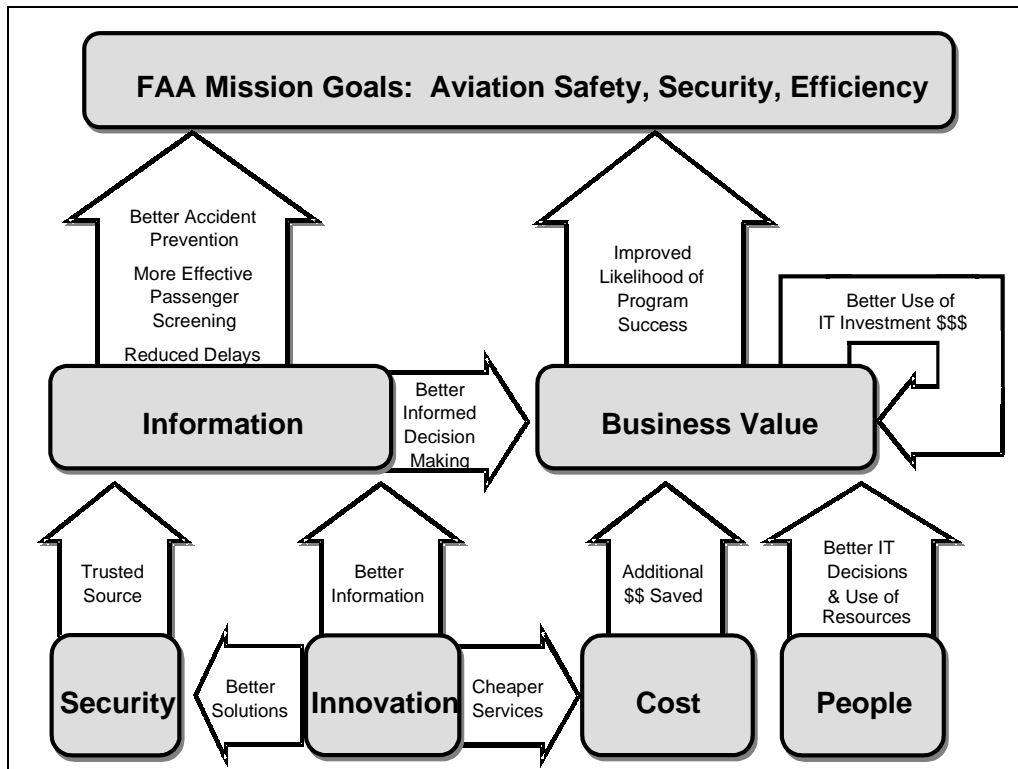| *Goals*	*Objectives*	*Strategies*
Information: Make reliable information available quickly.	*Accountability:* Select the most critical information and establish a single point of accountability for its definition and quality during FY00. *Quality:* Establish quality standards for critical information in FY00 and meet or exceed those standards in targeted databases during FY01 and FY02. *Access*: Ensure appropriate users have timely access to critical information in targeted databases during FY01 and FY02.	*Forum:* Establish a Data Management Forum at the appropriate level to enable agency-wide decisions, establish standards, assign data stewards, and to communicate effectively with internal and external customers. *Standards:* Inventory critical databases, develop a data architecture, establish a database certification process, and implement data standardization for core data elements. Focus first on critical information for external customers and then for internal customers. *Corporate Asset*: Identify the critical information needs of the agency, and establish mechanisms to ensure that accurate information is accessible in a

Goals	Objectives	Strategies
		timely, understandable and secure format, by managing information as a corporate asset.
Cost: Reduce the cost of delivering IT services without reducing service quality.	*Cost Reduction*: For each Fiscal Year beginning with FY01, reduce by a targeted percentage the unit cost of IT in delivering selected agency services, while maintaining requisite quality. *Total Cost of Ownership:* Determine the total cost of ownership of selected IT systems and services during FY00 and begin to manage those systems and services to optimize costs during FY01 and FY02.	*Baseline:* Each line of business and Integrated Product Team will baseline usage, quality, and unit costs of IT in delivering selected agency services, including those costs embedded in support services and supplier contracts. *Incentives:* Provide incentives for agency IT managers, suppliers, and service providers to take a corporate view of IT service provision with respect to cost and quality. *Optimize:* Optimize IT resources across the agency through the appropriate mix of initiatives including the elimination of unnecessary redundancies, consolidation of services, and the reprioritization of funding. Determine the total cost of ownership of selected IT systems and services in the context of portfolio management (see *Business Value* goal) to improve the quality of investment decisions, thereby driving down costs. Focus on major cost drivers such as telecommunications, computing infrastructure, and other program elements.
Security: Safeguard information assets.	*Assess:* Assess all existing critical information systems for security vulnerabilities during FY00 and FY01 and assess all new critical information systems as they are developed. *Authorize:* Apply cost-effective risk mitigations, certify, and authorize a targeted amount of all critical information systems by the end of FY02. *Assure:* Continuously assure that selected critical information	*Infrastructure:* Establish required infrastructure that includes policy, concept of operations, training, architecture, budgeting, processes, and methods. *Priorities:* Prioritize systems for assessment based on risk to the FAA, and then schedule mitigation, certification, and authorization based on severity of vulnerabilities and ease of mitigation. *Response Center:* Operate a Computer Security Incident Response Capability as the "nerve center" for detecting and responding to intrusions and incidents,

Goals	*Objectives*	*Strategies*
	systems withstand intrusion attempts.	and for overseeing penetration testing to evaluate effectiveness of security measures.
People: Acquire and maintain critical agency IT knowledge, skills, and abilities.	*Workforce Mix*: Determine the IT knowledge, skills, and abilities that are critical to supporting the agency's business. Determine the appropriate mix of federal and contractor resources to supply those critical IT knowledge, skills, and abilities during FY00 and FY01. *Workforce Development*: Acquire through a combination of federal and contractor resources, the additional critical IT knowledge, skills, and abilities needed to support IT in FY01 and FY02.	*Leadership:* Establish an agency-wide team responsible to lead the development of policy and guidelines to develop the workforce. *Requirements:* Identify the IT knowledge, skills, and abilities required to implement the IT Strategy goals. The implementation teams for the other five goals will work cooperatively with the People goal implementation team to identify those requirements. *Other Strategies - (To Be Developed by Implementation Team)*
Business Value: Optimize IT decisions and resources across the agency.	*Portfolio:* Implement portfolio management for selected IT services and capabilities by the end of FY01 to facilitate prioritizing specific systems for upgrade or replacement and to maximize common platforms, services, and infrastructure. *Architecture:* Establish an agency-wide information technology architecture consistent with the Clinger-Cohen Act and Office of Management and Budget guidance, and institutionalize its use to guide major investment and acquisition decisions, and to establish IT standards. The Enterprise Level components of the architecture will be developed during FY00 and the Technical Reference Model and Standards Profiles components	*Task Force:* Establish a special task force, a subset of the FAA Management Board, to decide how to use portfolios and total cost of ownership. The task force should focus particular attention on reducing costs during FY00 and FY01, establishing a business system portfolio, and establishing a long-term basis for the agency to align business operations and capital investment with anticipated funding. *Initial Architecture:* Establish an initial version of the agency-wide IT Architecture by leveraging and tailoring architecture products already developed such as the National Airspace System Architecture and architecture products of other government and industry organizations such as the Department of Defense's Common Operating Environment/Defense Information Infrastructure, Common Object Request Broker Architecture, and the Software

Goals	Objectives	Strategies
	will be developed during FY01 and FY02.	Engineering Institute's Product Line Architecture.
	Process: Institute mature processes which enable predictable cost and schedule, with fewer defects for an increasing set of targeted information systems during FY00, FY01, and FY02.	*Process Improvement:* Re-engineer selected agency business processes and continue improvement of selected agency engineering and acquisition processes following the FAA-integrated Capability Maturity Model®, in accordance with existing FAA initiatives.
Innovation: Exploit technology opportunities.	*Identify and Evaluate:* Establish a crosscutting systematic approach to identify and evaluate promising new information technologies during FY00. *Assess:* Assess selected programs for opportunities to exploit new information technologies during FY01 and FY02. *Exploit:* Integrate new information technologies into selected programs in ways that provide significant operational benefits or total cost of ownership advantages during FY01 and FY02.	*Research Team:* Establish an agency-wide IT research team to identify emerging IT technologies, assess their usefulness to the agency and look for ways to exploit these technologies to add business value to the organization. The team should focus special attention on Internet-related technologies. *Incentives:* Establish incentive programs to reward individuals and organizations that identify and adopt beneficial emerging technologies, and encourage broad collaboration on IT research and development projects. *Prototype:* Improve the process for transitioning prototypes into fully operational systems.

Figure 3 illustrates some of the value the goals contribute to each other, and to the FAA mission goals of *Aviation Safety*, *Security*, and *Efficiency*. The gray boxes in the diagram represent the goals, and the arrow-shaped boxes show the primary value that flows between those goals. For example, the *Business Value* goal contributes value to the FAA mission goals by improving the likelihood of program success (delivery of capabilities and quality of services). In addition, this goal contributes value to itself, through better use of IT investment dollars. The *Business Value* goal also benefits from the *Information* goal through better-informed decision making, the *Cost* goal through additional dollars saved, and the *People* goal through better IT decisions and use of resources.

Figure 3 - Goals Contribute Value to Each Other

Each of the Goals, Objectives, and Strategies are further described in the next sections.

2   Goal - Information: Make reliable information available quickly.

The FAA, in partnership with the aviation community, depends on vast amounts of information to safely and securely manage air traffic and to regulate the aviation industry. Dramatic growth in air traffic, increased collaboration between airspace users and the FAA for *Free Flight*, and new technologies, such as the Internet, increase the importance and difficulty of providing reliable timely information to agency users and staff. For example, reducing air travel delays requires that both the airlines and the FAA have up-to-date, accurate information on weather, airport conditions, and equipment outages. The infrastructure to enable such large-scale distributed exchange of information is being implemented over the next several years.

The objectives and strategies for the *Information* goal in this strategy were derived from the *FAA Data Management Strategy,* which was produced by an agency-wide team in response to the recognized need for a corporate information management program and in response to encouragement from Congress.

Objective - Accountability: Select the most critical information and establish a single point of accountability for its definition and quality during FY00.

In order to make reliable information available, the agency needs to establish a single point of accountability or *steward* for each critical piece of information. The steward will be responsible to ensure that the definition and quality of data is consistent across the agency.

Objective - Quality: Establish quality standards for critical information in FY00 and meet or exceed those standards in targeted databases during FY01 and FY02.

Each data steward must have objective quality standards for which he or she is responsible. Once quality standards are established, a steward will eliminate inconsistency, reduce redundancy, and take other needed steps to ensure the data available across the agency meets those standards.

Objective - Access: Ensure appropriate users have timely access to critical information in targeted databases during FY01 and FY02.

Information must be shared and made available to those who need it. To accomplish this, the paradigm must be changed to view data as a corporate asset. The agency needs to understand the data that needs to be shared and the mechanisms to accomplish this.

Strategy - Forum: Establish a Data Management Forum at the appropriate level to enable agency-wide decisions, establish standards, assign data stewards, and to communicate effectively with internal and external customers.

The Data Management Forum will assign stewards for data definition and quality. This Forum will also develop the data quality standards. Having membership at the appropriate level ensures that the Forum has the authority to make the needed decisions.

Strategy - Standards: Inventory critical databases, develop a data architecture, establish a database certification process, and implement data standardization for core data elements. Focus first on critical information for external customers and then for internal customers.

Critical databases must be inventoried so that stewards can identify redundancy, control quality, and ensure availability. Standardization will make it easier for users and systems to share information, reducing the cost to implement information systems, improving the quality of the information, and making it easier to disseminate. An agency-wide standard dictionary or metadata repository will be part of the data architecture. The repository will be incrementally grown and will capture the standard definitions. The data architecture, which is a component of the agency-wide IT architecture, will facilitate the standardization of data across the agency.

Strategy - Corporate Asset: Identify the critical information needs of the agency, and establish mechanisms to ensure that accurate information is accessible in a timely, understandable and secure format, by managing information as a corporate asset.

Accurate information must be available in a timely, accessible, understandable, and secure format to the users who need it. To accomplish this, data will be managed as a corporate asset. The agency must understand the data that needs to be shared and identify mechanisms to accomplish this. These mechanisms may include the current IT infrastructure, telecommunications infrastructure, web-based solutions, or emerging technologies.

3 Goal - Cost: Reduce the cost of delivering IT services without reducing service quality.

The FAA spends $2.1 billion annually on IT,[9] making it a high-volume buyer of information technology and services such as voice and data communications, desktops, and database management systems. By standardizing what it buys, by leveraging its position with vendors as a high-volume buyer, by coordinating the purchase and operation of related IT services, by creating the right management incentives, and by adhering to an agency-wide IT architecture (which exists only in part today), the agency will significantly improve the cost-effectiveness of IT. Reducing costs rather than just reducing the rate at which costs rise is necessary given projected agency budgets. The FAA will improve its understanding of the total cost of ownership from conception through implementation, operation, and eventual retirement for major systems. Better insight into total cost of ownership will enable lower overall systems costs.

Objective - Cost Reduction: For each Fiscal Year beginning with FY01, reduce by a targeted percentage the unit cost of IT in delivering selected agency services, while maintaining requisite quality.

The cost of IT in the delivery of services must be examined, and reductions in the unit cost of IT must be sought. By taking an agency-wide view of IT costs, greater economies of scale and cost reductions can be accomplished without reducing service quality. Reducing costs rather than just reducing the rate at which costs rise is necessary given projected agency budgets.

Objective - Total Cost of Ownership: Determine the total cost of ownership of selected IT systems and services during FY00 and begin to manage those systems and services to optimize costs during FY01 and FY02.

The *FAA Acquisition Management System* requires computing the total cost of ownership. Mechanisms to improve that computation, and to manage major systems with total cost more visible, will reduce overall cost and risk. Investment decisions on research and development, capital, and operations funds for a single program will be fully integrated. This ensures that the agency will have the resources available for operating the systems it acquires, and to do all the necessary research and development to reduce risk for critical capital programs.

Strategy - Baseline: Each line of business and Integrated Product Team will baseline usage, quality, and unit costs of IT in delivering selected agency services, including those costs embedded in support services and supplier contracts.

The first step in reducing costs is to determine the cost of IT in delivering agency services. It is vital that all costs are accounted for, including costs that are embedded in support services and supplier contracts. The usage and quality must also be baselined, to ensure that future cost reductions are not based on a reduction in quality or usage. While baselining cost, quality, and usage is difficult, and precise information may not be obtainable in the short-term, levels of cost, quality, and usage can be approximated using statistical sampling or other less costly methods.

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[9] *FAA Information Technology 5 Year Plan*, July 1999

Strategy - Incentives: Provide incentives for agency IT managers, suppliers, and service providers to take a corporate view of IT service provision with respect to cost and quality.

Because the agency spends so much on IT, there is a high return on investment from motivating those who manage those services to seek significant cost savings. The new performance-based compensation program offers the agency the needed flexibility to incentivize these managers. For external service providers, incentives can be provided through appropriate contract and performance mechanisms.

Strategy - Optimize: Optimize IT resources across the agency through the appropriate mix of initiatives including the elimination of unnecessary redundancies, consolidation of services, and the reprioritization of funding. Determine the total cost of ownership of selected IT systems and services in the context of portfolio management (see *Business Value* goal) to improve the quality of investment decisions, thereby driving down costs. Focus on major cost drivers such as telecommunications, computing infrastructure, and other program elements.

Consolidation, eliminating redundancy and reprioritizing funding will allow the agency to use its resources more efficiently. The efficient use of resources will drive agency cost reductions. This can be accomplished by standardizing what the agency buys, by leveraging its position with vendors as a high-volume buyer, and by coordinating the purchase and operation of related IT services. Determining the total life cycle costs will ensure that investment decisions on research and development, capital, and operations funds for a single program are fully integrated. Focusing attention on major cost drivers will have the greatest near-term impact.

4   Goal - Security: Safeguard information assets.

The phenomenal growth of the Internet and computer skills of the public has created unprecedented potential to threaten the critical infrastructure of the United States, including the air traffic management system. Compounding these opportunities is the rapid growth of automated information exchange between the FAA and airspace users. Responding to these threats, the FAA has developed a comprehensive program to assure that the National Airspace System and its supporting systems are immune to attack. Responding to *Presidential Decision Directive 63*, which mandates protection of the nation's critical infrastructure, the FAA has identified over 100 critical systems that are being "hardened" to resist attack. Additionally, the agency is establishing an incidents response center that will analyze attacks when they happen, ensure that they are promptly addressed, and continually probe the agency's information systems for new weaknesses.

In its *Critical Infrastructure Protection Plan,* published in March 1999, the FAA explained, at a high level, how it was going to respond to *Presidential Decision Directive 63*. The *draft FAA Information Systems Security Policy (Policy Number 1370.82)* and the *FAA Remediation Plan* provide further definition to that response. The objectives and strategies below were derived from those three documents.

Objective - Assess: Assess all existing critical information systems for security vulnerabilities during FY00 and FY01 and assess all new critical information systems as they are developed.

The first step in securing the agency's systems and information is assessing the vulnerabilities of critical information systems, which will detail the specific vulnerabilities of each system.

Objective - Authorize: Apply cost-effective risk mitigations, certify, and authorize a targeted amount of all critical information systems by the end of FY02.

Once vulnerabilities have been assessed, cost-effective mitigations must be employed to reduce the vulnerabilities to an acceptable level of risk, given the funding available. These mitigations can take the form of automation or procedural changes. Once vulnerabilities are mitigated, the system is certified to have an acceptable level of risk, and then authorized for use by a senior executive in the line of business that will operate the system.

Objective - Assure: Continuously assure that selected critical information systems withstand intrusion attempts.

Throughout the lifecycle of information systems, new threats will emerge and systems will be modified to meet changing user requirements. Security testing and validation throughout the system lifecycle is necessary. This testing provides assurance that the security of the system has not been weakened as a result of either new threats or system changes. Intrusion testing will be continually conducted to assess system vulnerabilities which, will drive additional mediations.

Strategy - Infrastructure: Establish required infrastructure that includes policy, concept of operations, training, architecture, budgeting, processes, and methods.

Adequate information security for an agency as large and distributed as the FAA requires significant infrastructure. The fundamental information security policy, concept of operations, and information security architecture is being published in 1999. Training must be conducted to ensure staff and management understand their information security responsibilities. Organizations must identify information security activities and budgets. Finally, processes and methods must enable information security policy to be implemented.

Strategy - Priorities: Prioritize systems for assessment based on risk to the FAA, and then schedule mitigation, certification, and authorization based on severity of vulnerabilities and ease of mitigation.

Given the monumental task of assessing all IT systems within the agency and the limited funding available with which to mitigate risks, those systems must be prioritized to ensure that the highest risk systems are protected first. Prioritization will be based on the value that those systems provide in support of the core FAA mission, goals and objectives.

Strategy - Response Center: Operate a Computer Security Incident Response Capability as the "nerve center" for detecting and responding to intrusions and incidents, and for overseeing penetration testing to evaluate effectiveness of security measures.

While adherence to the proper security management practices offers a means to reduce operational security risks to acceptable levels, no mitigation effort can guarantee that a system is totally immune to intrusion. At any given moment, some systems will be operating at higher than targeted risk levels. A Computer Security Intrusion Response Capability will act as the "SWAT" team to rapidly respond to attacks when they occur. Additionally, both successful and failed attacks will provide valuable information leading to new information security requirements that must be implemented in the various information systems. Because technology changes very rapidly, the agency must proactively and continually test and improve information security measures.

5   Goal - People: Acquire and maintain critical agency IT knowledge, skills, and abilities.

The aviation paradigm and information technology are changing so rapidly that keeping the workforce technologically current is daunting. Today, many FAA efforts focus on recruiting, retaining, and training its IT staff, but there is no consensus within the agency as to which are the most important IT knowledge, skills, and abilities, and no corporate program to acquire and develop people with those skills. Over the next three years, that consensus will be built, and programs put in place to acquire and develop people with critical IT knowledge, skills, and abilities, and to maintain those capabilities.

Objective - Workforce Mix: Determine the IT knowledge, skills, and abilities that are critical to supporting the agency's business. Determine the appropriate mix of federal and contractor resources to supply those critical IT knowledge, skills, and abilities during FY00 and FY01.

The agency must identify the IT knowledge, skills, and abilities that are critical in supporting its business operations. Once they are determined, the agency must decide the most cost-effective and efficient means for providing the critical IT knowledge, skills, and abilities. Given the rapidly changing business environment, the rapid evolution of IT, and continued constraints on personnel ceilings and budget resources, it is impractical to develop and maintain all necessary knowledge, skills, and abilities within the agency. Thus, the agency must determine the appropriate mix of federal and contractor resources to meet its business requirements.

Objective - Workforce Development: Acquire through a combination of federal and contractor resources, the additional critical IT knowledge, skills, and abilities needed to support IT in FY01 and FY02.

Once the agency determines which additional critical IT knowledge, skills, and abilities it requires to support business, they must be acquired through a combination of development within the agency, and the selection of capable and experienced contractors.

Strategy - Leadership: Establish an agency-wide team responsible to lead the development of policy and guidelines to develop the workforce.

A team with agency-wide membership will ensure that the group is focused on meeting total agency needs. The team will use the expertise available through other organizations including the government-wide Chief Information Officer's Council and the Office of Personnel Management. The team will leverage the IT-related portions of existing workforce development activities within the agency such as the integrated Process Group's Learning Resource Group, Research and Acquisition's Intellectual Capital Investment Plan Council, and the Aircraft Certification Curriculum.

Strategy - Requirements: Identify the IT knowledge, skills, and abilities required to implement the IT Strategy goals. The implementation teams for the other five goals will work cooperatively with the People goal implementation team to identify those requirements.

The agency workforce enables the successful implementation of the goals in the IT Strategy.

The goal implementation teams must work collaboratively to identify the knowledge, skills, and abilities that the agency requires to effectively implement these goals.

Other Strategies - (To Be Developed by Implementation Team)

Given the impact of the strategies for this goal, they require further investigation and development. The agency-wide team described in the *Leadership* strategy above will further develop these strategies, and they will be included in the next iteration of this strategy.

6   Goal - Business Value: Optimize IT decisions and resources across the agency.

The FAA is acquiring, developing, and operating over 400 IT services and information systems, which enable the agency to carry out virtually all of its business functions. The FAA must decide which IT services and systems to obtain from outside sources and which to provide internally. For those services that the FAA decides to provide internally, the agency must decide which IT systems to buy *off the shelf,* which to develop and build, which to retire, and which to update; and then smartly execute those decisions. New management techniques will be implemented to improve critical investment decisions and to more effectively carry them out. Related IT systems will be grouped into portfolios and managed to optimize the performance of the whole portfolio to support agency business objectives. Key processes on which execution depends will be re-engineered and systematically improved.

Objective - Portfolio: Implement portfolio management for selected IT services and capabilities by the end of FY01 to facilitate prioritizing specific systems for upgrade or replacement and to maximize common platforms, services, and infrastructure.

Managing IT as a portfolio will allow for more informed investment decisions. Decisions about individual programs are made in the context of overall portfolio objectives. Resources are optimized across the agency because investment decisions are based on the relative investment in services, such as navigation and weather, balancing the degree of risk a decision adds to the portfolio, and managing to the proper mix of maintenance and enhancements to existing systems, and the addition of new systems. Portfolio management supports the goals of the *FAA Acquisition Management System* because it incorporates the elements of lifecycle management and places acquisitions in an agency-wide context.

Objective - Architecture: Establish an agency-wide information technology architecture consistent with the Clinger-Cohen Act and Office of Management and Budget guidance, and institutionalize its use to guide major investment and acquisition decisions, and to establish IT standards. The Enterprise Level components of the architecture will be developed during FY00 and the Technical Reference Model and Standards Profiles components will be developed during FY01 and FY02.

The Clinger-Cohen Act, defines information technology architecture as "… an integrated framework for evolving or maintaining existing information technology and acquiring new information technology to achieve the agency's strategic goals and information resources management goals."[10]   *Office of Management and Budget Memorandum 97-02*, *Funding Information Systems Investments*, requires that, "Investments in major information systems … be consistent with Federal, agency, and bureau information architectures which: integrate agency work processes and information flows with technology to achieve the agency's strategic goals."[11] Consistent with the Clinger-Cohen Act, the FAA has decided to establish an agency-wide information technology architecture and use it to guide major investment decisions. An IT

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[10] *Information Technology Management Reform Act of 1995* (aka Clinger-Cohen Act), Section 5125 (d); http://irm.cit.nih.gov/itmra/itmra96.html
[11] *Office of Management and Budget Memorandum 97-02*, *Funding Information Systems Investments*, (October 25, 1996); http://cio.gov/raines.htm

architecture will allow the FAA to improve the cost effectiveness of IT as the agency leverages its position with vendors as a high-volume buyer. Additional economies of scale will be realized through the effective coordination of the purchase and operation of related IT services and management incentives to use the IT architecture. An agency-wide information technology architecture will also help guide portfolio management decisions.

Objective - Process: Institute mature processes which enable predictable cost and schedule, with fewer defects for an increasing set of targeted information systems during FY00, FY01, and FY02.

Numerous studies have shown the strong ties between applying mature processes and achieving consistent business results. Mature processes lead to predictable costs, schedule, and quality and to improved productivity and the ability to systematically absorb innovation.

Strategy - Task Force: Establish a special task force, a subset of the FAA Management Board, to decide how to use portfolios and total cost of ownership. The task force should focus particular attention on reducing costs during FY00 and FY01, establishing a business system portfolio, and establishing a long-term basis for the agency to align business operations and capital investment with anticipated funding.

The task force will be charged with determining the best use of portfolio management and total cost of ownership concepts to optimize resources across the agency. This may require the reallocation of funds both within a portfolio and across portfolios. The group should look for cost reductions to occur in the near-term, as well as implement programs and processes to align operations with anticipated funding in out-years.

Strategy – Initial Architecture: Establish an initial version of the agency-wide IT Architecture by leveraging and tailoring architecture products already developed such as the National Airspace System Architecture and architecture products of other government and industry organizations such as the Department of Defense's Common Operating Environment/Defense Information Infrastructure, Common Object Request Broker Architecture, and the Software Engineering Institute's Product Line Architecture.

Leveraging existing architecture products will provide a cost-effective approach to developing an information technology architecture. It will also ensure that the IT architecture and the National Airspace System Architecture are consistent and aligned over time.

Strategy - Process Improvement: Re-engineer selected agency business processes and continue improvement of selected agency engineering and acquisition processes following the FAA-integrated Capability Maturity Model®, in accordance with existing FAA initiatives.

The FAA integrated Capability Maturity Model®, based on commercial best practice, frames improvement efforts, which are focused primarily on achieving predictable cost, schedule, and quality. The agency has ongoing process improvement initiatives, which the IT Strategy must leverage. For instance, there is an effort being coordinated by the integrated Process Group, with

broad representation from Research and Acquisitions and from Air Traffic Services. That effort has been improving processes in more than a dozen acquisition programs and organizations.

7 Goal - Innovation: Exploit technology opportunities.

The air traffic management system is one of the largest and most complex systems in the world. It must be constantly modernized to meet the rapidly growing demands of the airspace users and the flying public. Reducing the already low fatal accident rate and improving the already high margin of security require new tools and new ways to look at data. Additionally, while the air traffic management system provides the greatest opportunity for exploiting new technology opportunities, there are also important opportunities in the other areas of the agency. The FAA needs to systematically identify which innovative information technologies can have the greatest impact and determine how best to integrate those technologies into its information systems. During the next several years, the agency will put in place a corporate approach to managing innovative technologies, and will evolve key IT systems to make best use of those technologies.

Objective - Identify and Evaluate: Establish a crosscutting systematic approach to identify and evaluate promising new information technologies during FY00.

The agency needs to better coordinate the resources used in evaluating new information technologies.   Uncoordinated efforts fragment funding and lessen the impact of these investigations.

Objective - Assess: Assess selected programs for opportunities to exploit new information technologies during FY01 and FY02.

Managing IT by portfolios and using total cost of ownership will make it easier to prioritize research and development efforts and identify programs that could benefit from innovative technologies. In some cases, the new technology may even lead to significant business process reengineering.   New technology could also cause the formation of a new program whose feasibility depends on that technology.

Objective - Exploit: Integrate new information technologies into selected programs in ways that provide significant operational benefits or total cost of ownership advantages during FY01 and FY02.

Where benefits clearly outweigh the risks, technologies that have the potential to improve program cost, schedule, or technical performance should be tried. Risks must be carefully explored and understood before a new technology is implemented.

Strategy - Research Team: Establish an agency-wide IT research team to identify emerging IT technologies, assess their usefulness to the agency and look for ways to exploit these technologies to add business value to the organization. The team should focus special attention on Internet-related technologies.

The IT research team will be responsible for evaluating emerging technologies for possible utilization within the agency. The team must insure that its research is aligned with business objectives, and that it is looking for solutions to business problems. An emerging technology must show promise in solving business problems to receive consideration for review. The team

should measure an emerging technology based on the business value it adds to the agency, and must weigh all risks before a technology is implemented. The other goal implementation teams should work cooperatively with this team to identify the emerging technologies, which will potentially assist in the implementation of the IT Strategy goals.

Strategy - Incentives: Establish incentive programs to reward individuals and organizations that identify and adopt beneficial emerging technologies, and encourage broad collaboration on IT research and development projects.

Individuals and FAA organizations should be encouraged to seek business solutions using technology. New uses for old technology and emerging technologies that are proven to add value to business within organizations, should be leveraged agency-wide, if feasible. Collaboration of research and development efforts will better utilize agency resources.

Strategy - Prototype: Improve the process for transitioning prototypes into fully operational systems.

Prototype projects allow the agency to test new technologies to better explore their possible agency-wide deployment. Once a prototype has been proven to add value to the agency, it must be transitioned into a fully operational system. This transition should be as smooth and seamless as possible, with minimal user interruption.

8 Next Steps

A common theme in many of the objectives is to focus on *critical*, *selected* or *targeted* information, databases, positions, etc. Executives from the various lines of business and key staff offices will collectively select the items on which to focus. By leaving the selection open at this time, it allows the agency to concentrate the objectives on those items that will have the greatest impact on the goals. The criteria for this selection will be the importance to the agency in achieving its mission goals, the cost-benefit of implementing changes, and the ability to make improvements while continuing to deliver quality services.

Many of the goals have a strategy that proposes the establishment of a group or team to implement the goal. Where appropriate, existing groups or a combination of existing groups should be leveraged to serve as these implementation teams, rather than create new ones. It is essential that the members of these implementation teams are at the appropriate level and have the authority to make the necessary decisions for their organization.

The next step in this process is to complete implementation plans for the goals. The strategies for the *Information* and *Security* goals are developed, and have implementation plans nearing completion, the *FAA Data Management Strategy* and the *FAA Remediation Plan*, respectively. Teams with agency-wide membership developed these plans. Similar plans must be developed around the other four goals. With the Office of Information Services and Chief Information Officer as the lead, teams will be formed with membership from across the agency to develop these plans. The Office of Information Services and Chief Information Officer will ensure the alignment of the implementation plans with each other and with the FAA mission goals. Periodically, the IT Strategy will be revised to respond to insights gained from the implementation teams, changes in the business or technological environment, and to ensure alignment with the FAA mission goals.

The FAA's strategic goals to increase the safety, security, and efficiency of the National Airspace System depend on effective management of the agency's information technology resources. The IT Strategy represents the first iteration of the FAA's agency-wide approach to IT management. It establishes the strategic framework to guide IT investment decisions and the agency-wide management of IT systems and services. The FAA must focus on optimizing decisions across the agency, which will require a culture change. The success of this strategy depends on making that change. Fortunately, there is a strong sense of commitment to that change from the FAA Management Board. That commitment, and the willingness of the lines of business to work cooperatively and align funding to meet the strategy's goals, will ensure this strategy's success.

Appendix A: IT Strategy's Probable Impact on FAA Corporate Projects

	Information	Cost	Security	People	Business Value	Innovation
Safer Skies: Runway Safety Program (incl. AMASS)						
Safer Skies Commercial Aviation	X					
Safer Skies General Aviation	X					
Safe Flight 21	X					
GPS Implementation						
Global Analysis and Information Network (GAIN)						
Aviation Safety Action Program	X					
National Aviation Safety Data Analysis Center (NASDAC)	X				X	X
NAS Modernization Safety Assessment						
Dangerous Goods	X					
Space Transportation Vehicle Safety						
Air Transportation Oversight System (ATOS)	X		X			
Employee Drug and Alcohol-Free Workplace						
Safety Risk Policy Implementation						
Transition of Oversight Responsibilities at Air Force Launch Sites to FAA						
Certification of Screening Companies						
Deploy Advanced Security Technology						
Implement Automated Passenger Screening						
Facility Security						
FAA Information Security Program	X	X	X	X	X	X
Free Flight Phase I	X				X	
Restricted Elimination and Flexible Flight Planning						
National Airspace Redesign	X				X	
Improve NAS Communications	X	X	X	X	X	X
Standard Terminal Automation Replacement System (STARS)			X			
Display System Replacement (DSR)			X			

	Information	Cost	Security	People	Business Value	Innovation
Operational and Supportability Implementation System (OASIS)	X		X		X	
Improve Aviation Weather Information for the NAS						
Revitalize Existing Structures, Technology and Operational Resources (RESTORE)		X	X		X	X
Host/ Oceanic Modernization	X	X	X		X	X
NAS Airport Integration						
Space and Air Traffic Management System (SATMS)						
Opportunity for All						
Accountability Board						
Conclude Implementing the Cost Accounting System (CAS)	X			X		
Receive Unqualified Audit Opinion for FY 1999						
Human Resources Redesign	X	X	X	X	X	X
Compensation Implementation				X		
Career Paths and Development for the 21st Century Workforce				X		
Information Technology Strategy	X	X	X	X	X	X
FAA-wide Major Procurement Program Goals						
Labor-Management Partnership	X					
Communications Strategy	X			X		
Cost Management		X			X	X
Global Emissions	X					
Local Air Quality	X					
Airplane Noise	X					
International Acceptance and Implementation of Satellite Navigation						
ICAO Safety Oversight Program Implementation						

Appendix B: Sample Results Chain

FAA Line of Business: ABA	
Strategic Outcome Supported by the Objective: Increase System Efficiency	
Objective: (ABA-1) Identify agency service costs.	
Strategy: (ABA-1.a) Deploy cost accounting system	
CSFs	• Get executive buy-in and LOB support for implementation • Commitment of resources • IG approval • Understanding and making appropriate decisions on the level of detail to track • Gaining actual (vs. estimates) labor distribution information • Making the right decisions around labor distribution and cost management • Policies that allow organizations to re-invest savings in their LOB (not using the system to punish, using it to reward).
Measures	
IT Implications	• Will increase the need for common data definitions, better documentation, etc. (DD1) • Will increase the need for common data structures, reduction of duplicative databases, etc. (DS1) • Increases the risk of greater propagation of duplicative databases, dueling numbers, etc. (DS2) • Provides opportunities for shared telecommunications architecture and consolidated services (T1) • Creates need for more bandwith (T2) • Increases need for internet accessibility for FAA users (I1)
IT Strengths	• COTS Hardware/Software (HS11) • Hardware/Software Flexibility (HS5) • Availability of upgrades of Hardware/Software (HS12) • Hardware/Software Reliability (HS3) • Hardware/Software Stability (HS4)
IT Weaknesses / Barriers	• Reporting/collection procedures (P1) • Hardware/Software Complexity (HS9) • Data Accurancy (D2) • Data Volume (D9)
IT Opportunities	• Provides opportunity for decreasing data translation (ABS3) • Creates the opportunity for a comprehensive, integrated set of business/administrative systems (ABS4) • Data Standardization (D11) • Data accessibility/availability (D7)
IT Threats / Risks	• Incentives to collect data or report accurately (P2) • Delivery time of hardware/software (HS13) • Hardware/software maintainability/supportability (HS7) • Interface Standards (I2) • Data cost (D1) • Data accuracy (D2)
IT Objectives	• Standardizing data across LOBs • Provide web-enabled reporting tools and data for analytical capability • Incremental delivery of capabilities • Maximize integration across new business systems
IT Strategies	

Please note: This chain is for illustration purposes only. The data is incomplete, so that it will fit on one page.